PATENT ABSTRACTS OF JAPAN

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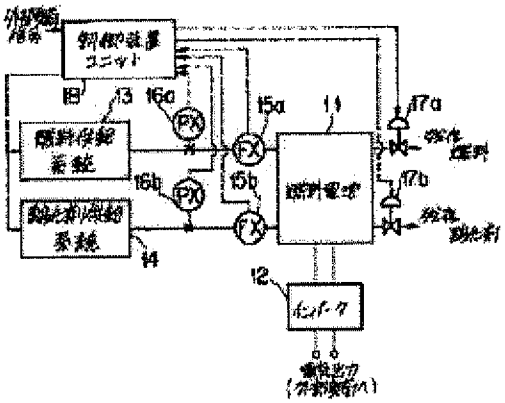
(54) OPERATION AND CONTROL OF FUEL CELL

(57)Abstract:
PURPOSE: To improve load-follow up feature when an external load is increased and simplify the design of an invertor device by controlling at least one side pressure out of pressures of fuel and oxidizer supplied to a fuel cell.
CONSTITUTION: Supply pressures of both fuel and oxidizer supplied to a fuel cell (11) are controlled by adjusting openings of two pressure control valves (17a) and (17b). An external load signal an signals according to supply amounts of fuel and oxidizer from flowmeters (15a) and (15b) and signals according to the supply pressures of a fuel and an oxidizer from pressure gages (16a) and (16b) are inputted to a controller unit (18). Respective designated control signals corresponding to above respective input signals are outputted to a fuel supplying line (13) and an oxidizer supplying line (14) and an invertor (12) respectively from the controller unit (18) together with a control signal for adjusting opening of the pressure control valves (17a) and (17b).



* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1]An operation control method of a fuel cell controlling at least one pressure among fuel and oxidizers which are supplied to a fuel cell.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the operation control method of a fuel cell.
[0002]
[Description of the Prior Art]The operation control method of the conventional fuel cell is explained below with reference to drawing 2.
[0003]The fuel cell 1 has structure which infixed the electrolyte (neither is illustrated), for example between the anode pole and the cathode pole. It is connected to said fuel cell 1, and the inverter device 2 outputs the desired electrical and electric equipment to external load. The fuel feed system 3 is connected with said anode pole of said fuel cell 1. The oxidizer supplying system 4 is connected with said cathode pole of said fuel cell 1. The two flow instruments 5a and 5b are infixed in piping between said fuel feed system 3 and said fuel cell 1, and piping between the oxidizer supplying system 4 and said fuel cell 1, respectively. The signal based on the amount of supply of fuel and an oxidizer is inputted into the control device unit 6, respectively from an external load signal and said flow instruments 5a and 5b. From said control device unit 6, a predetermined control signal is outputted to said fuel feed system 3 and said oxidizer supplying system 4, and said inverter device 2, respectively.
[0004]When quantity of electricity consumed with external load increases in the fuel cell generation system of composition of being shown in such drawing 2, the information is outputted to said fuel feed system 3, said oxidizer supplying system 4, and said inverter device 2 through said control device unit 6, respectively as an external load signal, The voltage drop accompanying the increase of fuel and an oxidizer and the electric-generating-power increase of the fuel cell 1 corresponding to the electric consumption increase of stock is amended, and it is controlled so that the ac output of rating is obtained. On the other hand, when quantity of electricity consumed with external load decreases, the information is outputted to said fuel feed system 3, said oxidizer supplying system 4, and said inverter device 2 through said control device unit 6, respectively as an external load signal, The power surge accompanying the reduction of fuel and an oxidizer and the electric-generating-power reduction of the fuel cell 1 corresponding to the electric consumption decrement is amended, and it is controlled so that the ac output of rating is obtained.
[0005]By the way, the general electric-generating-power characteristic of a fuel cell is shown in drawing 3. When the supply pressure of fuel or an oxidizer is constant, as shown in drawing 3, the fuel in a fuel cell and the amount of consumption of an oxidizer increase with increase of the electric generating power of a fuel cell, and output voltage descends. As a result, in order to make the ac output of rating profitably like, it is necessary to carry out pressure up with an inverter device. However, it is possible to increase fuel cell output voltage and fuel cell electric generating power by raising the supply pressure of the fuel or the oxidizer supplied to a fuel cell.
[0006]

[Problem to be solved by the invention]Since the operation control method of the conventional fuel cell mentioned above was what amends the voltage drop and rise accompanying the change in fuel and an oxidizer which fixed the supply pressure of fuel or an oxidizer and balanced the amount of electric consumption increase and decrease, and electric-generating-power increase of a fuel cell, there were the following problems.
(1) If the electric generating power of the fuel cell 1 is increased corresponding to the increase in external load, as shown in drawing 3, fuel cell output voltage declines greatly.
[0007](2) Since the flattery nature of the fuel feed system 3 and the oxidizer supplying system 4 is dramatically inferior even if you are going to make it increase the amount of supply of fuel and an oxidizer, in order to increase electric generating power, it cannot be made to follow as a fuel cell generation system to the increase in external load with a quick response.
(3) If the electric generating power of the fuel cell 1 is decreased corresponding to reduction in external load, as shown in drawing 3, fuel cell output voltage rises greatly.
(4) The design of the inverter device which considered the output voltage width for a fall and rise of a fuel cell output as shown in the above (1) and (3) is needed.
[0008]The purpose of this invention tends to provide the operation control method of the fuel cell which load flattery nature of the fuel cell at the time of the increase in external load is made good, and can simplify the design of an inverter device.
[0009]
[Means for solving problem]This invention is an operation control method of the fuel cell controlling at least one pressure among the fuel and the oxidizers which are supplied to a fuel cell.
[0010]
[Function]By according to this invention, controlling at least one pressure among the fuel and the oxidizers which are supplied to a fuel cell, that is, rising and dropping at least one supply pressure among fuel and an oxidizer (rise and fall), Fuel cell electric generating power can be fluctuated from the relation shown in drawing 3 mentioned above. Therefore, since the supply pressure to the fuel cell of fuel or an oxidizer can be gone up in an instant corresponding to the increase in external load if only the supply pressure which can hold necessary fuel or the flow of an oxidizer is in a fuel feed system and an oxidizer supplying system, it becomes possible to increase the electric generating power of a fuel cell in an instant.
[0011]The fall of the output voltage by electric-generating-power increase of a fuel cell or the rise of the output voltage by electric-generating-power reduction of a fuel cell, If small among the fuel and the oxidizers which are supplied to a fuel cell which was mentioned above, it will become possible by making it go up and down one supply pressure to make small fuel cell output voltage variation width.
[0012]
[Working example]Hereafter, the working example of this invention is described in detail with reference to drawing 1.
[0013] Drawing 1 is a schematic view showing a fuel cell generation system. The fuel cell 11 has structure which infixed the electrolyte (neither is illustrated), for example between the anode pole and the cathode pole. It is connected to said fuel cell 11, and the inverter device 12 outputs the desired electrical and electric equipment to external load. The fuel feed system 13 is connected with said anode pole of said fuel cell 11. The oxidizer supplying system 14 is connected with said cathode pole of said fuel cell 1. The two flow instruments 15a and 15b are infixed in piping between said fuel feed system 13 and said fuel cell 11, and piping between the oxidizer supplying system 14 and said fuel cell 11, respectively. The two pressure gauges 16a and 16b are arranged, respectively, in order to measure the fuel supply pressure of the upstream of said flow instrument 15a of said piping, and the oxidizer supply pressure of the upstream of said flow instrument 15b of said piping.
[0014]The two pressure control valves 17a and 17b, It is infixed in the downstream (remaining fuel discharge piping, residual oxidizer discharge piping) of said fuel cell, respectively, and the supply

pressure of the fuel and the oxidizer which are supplied to said fuel cell 11 can be controlled now by adjusting the opening of each of said control valves 17a and 17b. An external load signal, the signal based on the amount of supply of said flow instruments 15a and 15b to fuel and an oxidizer, and the signal based on the supply pressure of said pressure gauge 16 to fuel and an oxidizer are inputted into the control device unit 18. From said control device unit 18, a predetermined control signal is outputted to said fuel feed system 3 and said oxidizer supplying system 4, and said inverter device 12, respectively, and the control signal which adjusts the opening of each of said pressure control valves 17a and 17b is outputted.

[0015]In such a fuel cell generation system, if an external signal is inputted into said control device unit 18, It is adjusted securing a necessary fuel flow and oxidizer flow rate with the oxidizer supply pressure supplied from the fuel supply pressure to which the opening of each of said pressure control valves 17a and 17b is supplied from said fuel feed system 13 with said control device unit 18, and said oxidizer supplying system 14. It becomes possible to control the fuel cell electric-generating-power characteristic to this control system.

[0016]That is, fuel cell electric generating power can be made to fluctuate from the relation shown in drawing 3 mentioned above by risen and dropping at least one supply pressure among fuel and an oxidizer (rise and fall). Therefore, if only the supply pressure which can hold necessary fuel or the flow of an oxidizer is in the fuel feed system 13 and the oxidizer supplying system 14, corresponding to the increase in external load, in an instant, said each pressure control valves 17a and 17b are used, and the supply pressure to said fuel cell 11 of fuel and an oxidizer can be gone up. That is, since the load flattery nature of said fuel cell 11 can be improved at the time of the increase in external load, it becomes possible to increase the electric generating power of said fuel cell 11 in an instant.

[0017]The fall of the output voltage by electric-generating-power increase of the fuel cell 11 shown in drawing 3 mentioned above, Or it becomes possible to make small fuel cell output voltage variation width by making it go up and down the supply pressure of the fuel and the oxidizer which are supplied to the fuel cell 11 which also mentioned above the rise of the output voltage by electric-generating-power reduction of a fuel cell. As a result, the design of the inverter device 12 can be simplified.

[0018]Although the supply pressure of both fuel and an oxidizer was controlled by said working example, even if it controls one of supply pressures, it is possible to attain the almost same effect as an working example.

[0019]

[Effect of the Invention]By controlling at least one pressure among the fuel and the oxidizers which are supplied to a fuel cell according to the operation control method of the fuel cell concerning this invention, as explained in full detail above, (1) [0020] which can simplify the design of an inverter device since (2) fuel-cell output voltage variation width which can make good load flattery nature of the fuel cell at the time of the increase in external load by using the characteristic of the fuel cell electric-generating-power increase by supply-pressure rise of fuel or an oxidizer can be made small (3) as opposed to a fuel cell with which differential pressure is built to the supply pressure of fuel like especially a solid electrolyte and a solid polymer electrolyte, and an oxidizer -- ** very effective for reduction of the improvement in external load flattery nature, and output voltage variation width -- do a prominent effect so.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The schematic view showing the fuel cell generation system used for the operation control method of the fuel cell in the working example of this invention.
[Drawing 2]The schematic view showing the fuel cell generation system used for the operation control method of the conventional fuel cell.
[Drawing 3]The diagram showing the general electric-generating-power characteristic of a fuel cell.
[Explanations of letters or numerals]
11 [-- An oxidizer supplying system, 17a, 17b / -- A pressure control valve, 18 / -- Control device unit.] -- A fuel cell, 12 -- An inverter device, 13 -- A fuel feed system, 14

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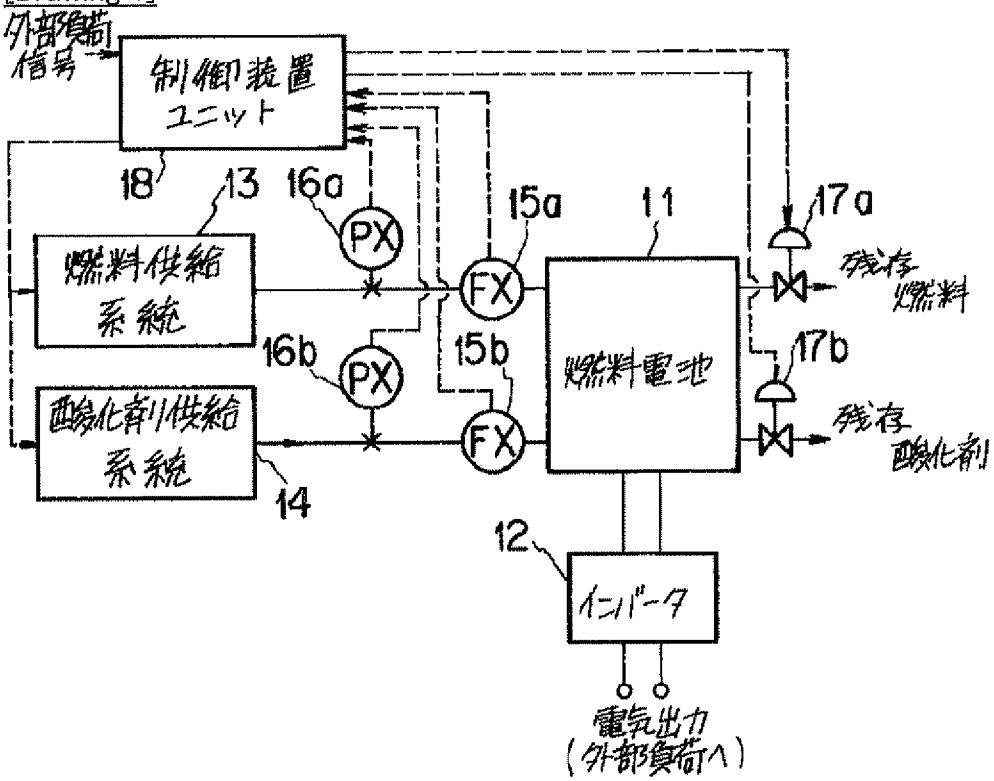
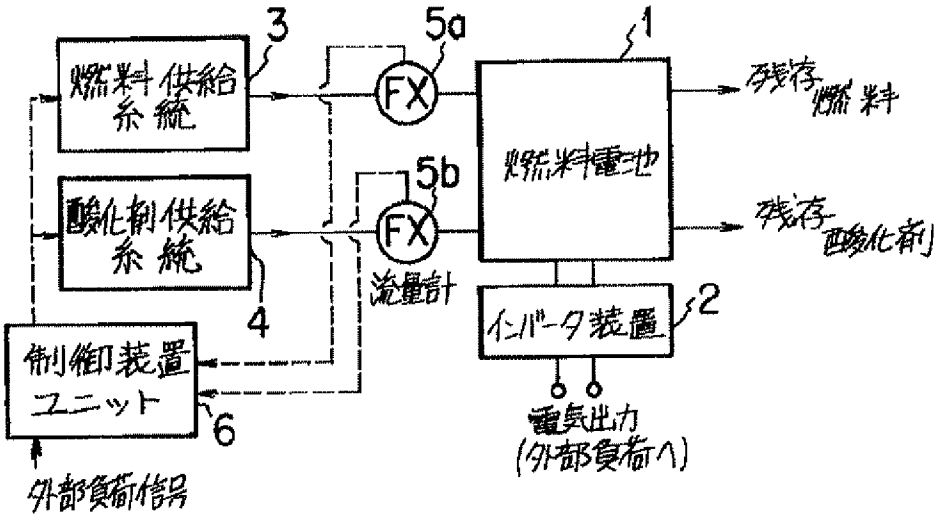
DRAWINGS

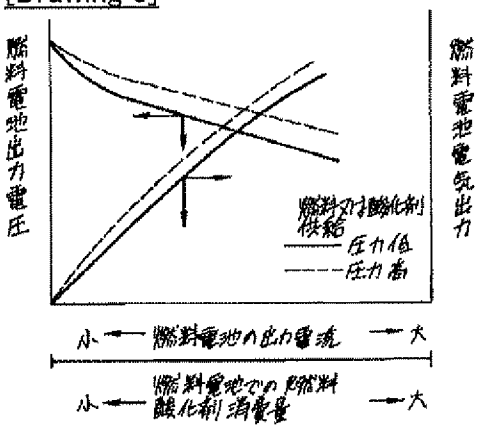
[Drawing 1]



[Drawing 2]



[Drawing 3]



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(3)

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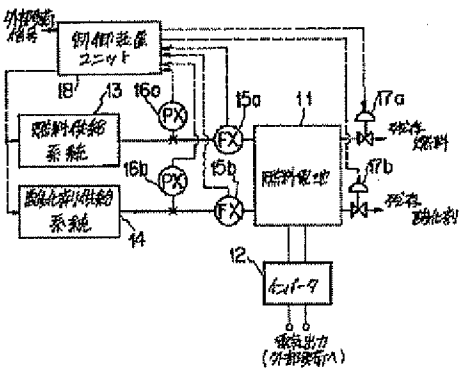

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審査請求　未請求　請求項の数１　ＯＬ　（全　５　頁）

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(22)出願日　平成５年(1993)３月４日

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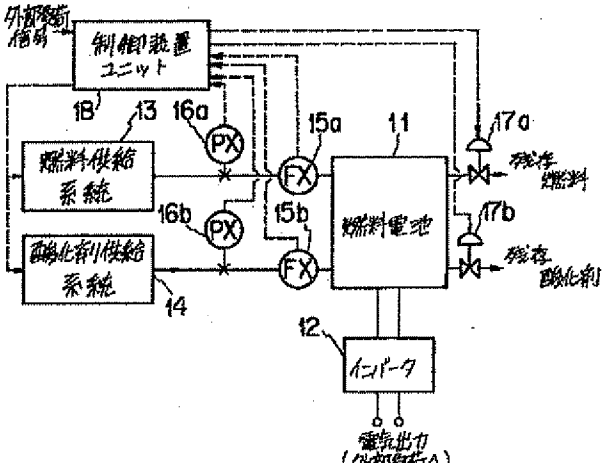
(54)【発明の名称】　燃料電池の運転・制御方法

(57)【要約】

【目的】　外部負荷増加時の燃料電池の負荷追従性を良好にし、かつインバータ装置の設計を簡素化することが可能な燃料電池の運転・制御方法を提供しようとするものである。

【構成】　燃料電池１１に供給される燃料および酸化剤のうち、少なくとも一方の圧力を制御して前記燃料電池１１の電気出力特性を変動させることを特徴としている。



【特許請求の範囲】
【請求項１】　燃料電池に供給される燃料および酸化剤のうち、少なくとも一方の圧力を制御することを特徴とする燃料電池の運転・制御方法。

【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、燃料電池の運転・制御方法に関する。
【０００２】
【従来の技術】従来の燃料電池の運転・制御方法を図２を参照して以下に説明する。
【０００３】燃料電池１は、例えばアノード極とカソード極の間に電解質（いずれも図示せず）を介装した構造になっている。インバータ装置２は、前記燃料電池１に接続され、所望の電気を外部負荷に出力する。燃料供給系統３は、前記燃料電池１の前記アノード極に連結されている。酸化剤供給系統４は、前記燃料電池１の前記カソード極に連結されている。２つの流量計５ａ、５ｂは、前記燃料供給系統３と前記燃料電池１の間の配管、酸化剤供給系統４と前記燃料電池１の間の配管にそれぞれ介装されている。制御装置ユニット６には、外部負荷信号と前記流量計５ａ、５ｂから燃料および酸化剤の供給量に基づく信号がそれぞれ入力される。前記制御装置ユニット６からは、前記燃料供給系統３および前記酸化剤供給系統４と前記インバータ装置２にそれぞれ所定の制御信号が出力される。
【０００４】このような図２に示す構成の燃料電池発電システムにおいて、外部負荷で消費される電気量が増加した時にはその情報が外部負荷信号として前記制御装置ユニット６を通して前記燃料供給系統３、前記酸化剤供給系統４および前記インバータ装置２にそれぞれ出力され、その電気消費増加量に見合った燃料、酸化剤の増大および燃料電池１の電気出力増大に伴う電圧降下を補正し、定格の交流出力が得られるように制御される。一方、外部負荷で消費される電気量が減少した時にはその情報が外部負荷信号として前記制御装置ユニット６を通して前記燃料供給系統３、前記酸化剤供給系統４および前記インバータ装置２にそれぞれ出力され、その電気消費減少量に見合った燃料、酸化剤の減少および燃料電池１の電気出力減少に伴う電圧上昇を補正し、定格の交流出力が得られるように制御される。
【０００５】ところで、燃料電池の一般的な電気出力特性を図３に示す。燃料または酸化剤の供給圧力が一定の場合には、図３に示すように燃料電池の電気出力の増大と共に燃料電池での燃料、酸化剤の消費量は増加し、出力電圧は降下していく。その結果、定格の交流出力を得ようとするためにはインバータ装置で昇圧する必要がある。ただし、燃料電池に供給される燃料または酸化剤の供給圧力を上昇させることによって、燃料電池出力電圧、燃料電池電気出力を増大させることが可能である。
【０００６】
【発明が解決しようとする課題】前述した従来の燃料電池の運転・制御方法は、燃料または酸化剤の供給圧力を一定にして電気消費増減量に見合った燃料、酸化剤の増減および燃料電池の電気出力増大に伴う電圧降下・上昇を補正するものであるため、次のような問題があった。
（１）外部負荷の増加に対応して燃料電池１の電気出力を増大させると、図３に示すように燃料電池出力電圧が大きく低下していく。
【０００７】（２）電気出力を増大させるために燃料、酸化剤の供給量を増加させようとしても、燃料供給系統３、酸化剤供給系統４の追従性が非常に劣るため、応答性の速い外部負荷増加に対し燃料電池発電システムとして追従させることができない。
（３）外部負荷の減少に対応して燃料電池１の電気出力を減少させると、図３に示すように燃料電池出力電圧が大きく上昇していく。
（４）前記（１）、（３）のような燃料電池出力の低下および上昇に際しての出力電圧幅を配慮したインバータ装置の設計が必要になる。
【０００８】本発明の目的は、外部負荷増加時の燃料電池の負荷追従性を良好にし、かつインバータ装置の設計を簡素化することが可能な燃料電池の運転・制御方法を提供しようとするものである。
【０００９】
【課題を解決するための手段】本発明は、燃料電池に供給される燃料および酸化剤のうち、少なくとも一方の圧力を制御することを特徴とする燃料電池の運転・制御方法である。
【００１０】
【作用】本発明によれば、燃料電池に供給される燃料および酸化剤のうち、少なくとも一方の圧力を制御する、つまり燃料および酸化剤のうち、少なくとも一方の供給圧力を上昇・降下（昇降）させることによって、前述した図３に示す関係から燃料電池電気出力を増減することができる。したがって、燃料供給系統内、酸化剤供給系統内に所要の燃料または酸化剤の流量が保持できるだけの供給圧力があれば、外部負荷増加に対応して瞬時に燃料または酸化剤の燃料電池への供給圧力を上昇できるため、燃料電池の電気出力を瞬時に増大させることが可能になる。
【００１１】また、燃料電池の電気出力増大による出力電圧の低下、または燃料電池の電気出力減少による出力電圧の上昇も、前述したような燃料電池へ供給される燃料および酸化剤のうち少なくと一方の供給圧力を昇降させることにより燃料電池出力電圧変化幅を小さくすることが可能になる。
【００１２】
【実施例】以下、本発明の実施例を図１を参照して詳細に説明する。

【００１３】図１は、燃料電池発電システムを示す概略図である。燃料電池１１は、例えばアノード極とカソード極の間に電解質（いずれも図示せず）を介装した構造になっている。インバータ装置１２は、前記燃料電池１１に接続され、所望の電気を外部負荷に出力する。燃料供給系統１３は、前記燃料電池１１の前記アノード極に連結されている。酸化剤供給系統１４は、前記燃料電池１の前記カソード極に連結されている。２つの流量計１５ａ、１５ｂは、前記燃料供給系統１３と前記燃料電池１１の間の配管、酸化剤供給系統１４と前記燃料電池１１の間の配管にそれぞれ介装されている。２つの圧力計１６ａ、１６ｂは、前記配管の前記流量計１５ａの上流側の燃料供給圧力、前記配管の前記流量計１５ｂの上流側の酸化剤供給圧力を測定するためにそれぞれ配置されている。

【００１４】２つの圧力コントロール弁１７ａ、１７ｂは、前記燃料電池の下流側（残存燃料排出配管、残存酸化剤排出配管）にそれぞれ介装され、前記各コントロール弁１７ａ、１７ｂの開度を調節することにより前記燃料電池１１に供給される燃料および酸化剤の供給圧力を制御できるようになっている。制御装置ユニット１８には、外部負荷信号と、前記流量計１５ａ、１５ｂから燃料および酸化剤の供給量に基づく信号と、前記圧力計１６から燃料および酸化剤の供給圧力に基づく信号とが入力される。前記制御装置ユニット１８からは、前記燃料供給系統３および前記酸化剤供給系統４と前記インバータ装置１２にそれぞれ所定の制御信号が出力されると共に、前記各圧力コントロール弁１７ａ、１７ｂの開度を調節する制御信号が出力される。

【００１５】このような燃料電池発電システムにおいて、外部信号が前記制御装置ユニット１８に入力されると、前記制御装置ユニット１８により前記各圧力コントロール弁１７ａ、１７ｂの開度が前記燃料供給系統１３から供給される燃料供給圧力および前記酸化剤供給系統１４から供給される酸化剤供給圧力と共に所要の燃料流量および酸化剤流量を確保しながら調節される。かかる制御方式に燃料電池電気出力特性を制御することが可能になる。

【００１６】すなわち、燃料および酸化剤のうち、少なくとも一方の供給圧力を上昇・降下（昇降）させることによって、前述した図３に示す関係から燃料電池電気出力を増減させることができる。したがって、燃料供給系統１３内、酸化剤供給系統１４内に所要の燃料または酸化剤の流量が保持できるだけの供給圧力があれば、外部負荷増加に対応して瞬時に燃料、酸化剤の前記燃料電池１１への供給圧力を前記各圧力コントロール弁１７ａ、１７ｂを用いて上昇できる。つまり、外部負荷増加時において前記燃料電池１１の負荷追従性を高めることができるため、前記燃料電池１１の電気出力を瞬時に増大させることが可能になる。

【００１７】また、前述した図３に示す燃料電池１１の電気出力増大による出力電圧の低下、または燃料電池の電気出力減少による出力電圧の上昇も、前述したような燃料電池１１に供給される燃料、酸化剤の供給圧力を昇降させることにより燃料電池出力電圧変化幅を小さくすることが可能になる。その結果、インバータ装置１２の設計を簡素化することができる。

【００１８】なお、前記実施例では燃料および酸化剤の両方の供給圧力を制御したが、いずれか一方の供給圧力を制御しても実施例とほぼ同様な効果を達成することが可能である。

【００１９】

【発明の効果】以上詳述したように、本発明に係わる燃料電池の運転・制御方法によれば燃料電池に供給される燃料および酸化剤のうち、少なくとも一方の圧力を制御することによって、（１）燃料または酸化剤の供給圧力上昇による燃料電池電気出力増大の特性を利用することで外部負荷増加時の燃料電池の負荷追従性を良好にできる、（２）燃料電池出力電圧変化幅を小さくできるためにインバータ装置の設計を簡素化できる、

【００２０】（３）特に固体電解質、固体高分子電解質のような燃料、酸化剤の供給圧力に差圧をたてられるような燃料電池に対し、外部負荷追従性の向上および出力電圧変化幅の縮小のために非常に効果的である、等顕著な効果を奏する。

【図面の簡単な説明】

【図１】本発明の実施例における燃料電池の運転・制御方法に使用される燃料電池発電システムを示す概略図。

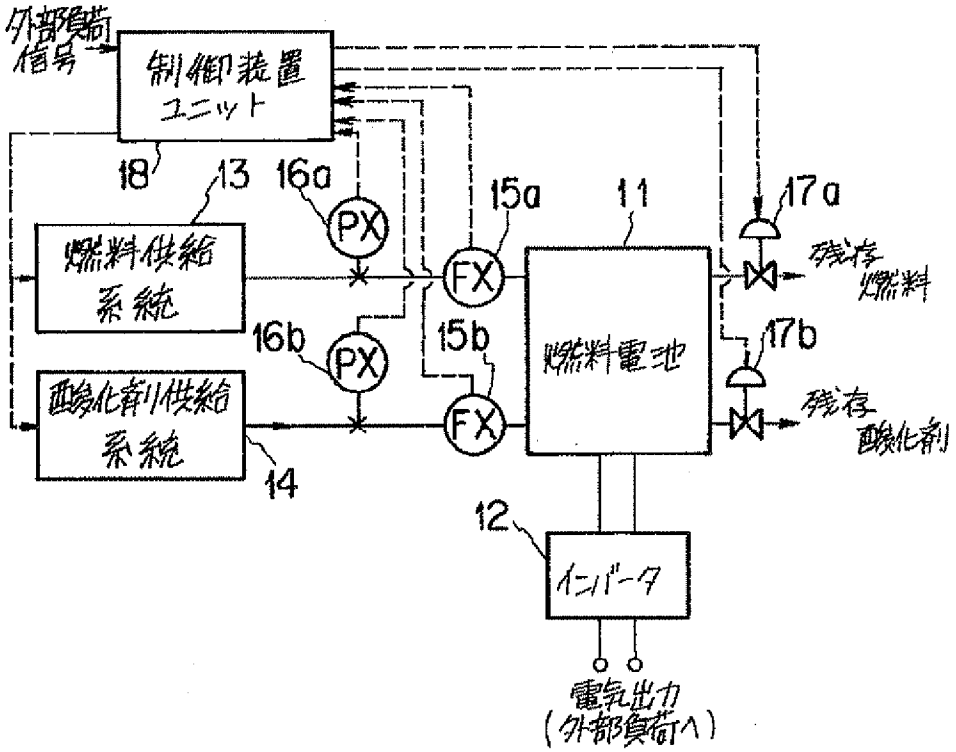
【図２】従来の燃料電池の運転・制御方法に使用される燃料電池発電システムを示す概略図。

【図３】燃料電池の一般的な電気出力特性を示す線図。

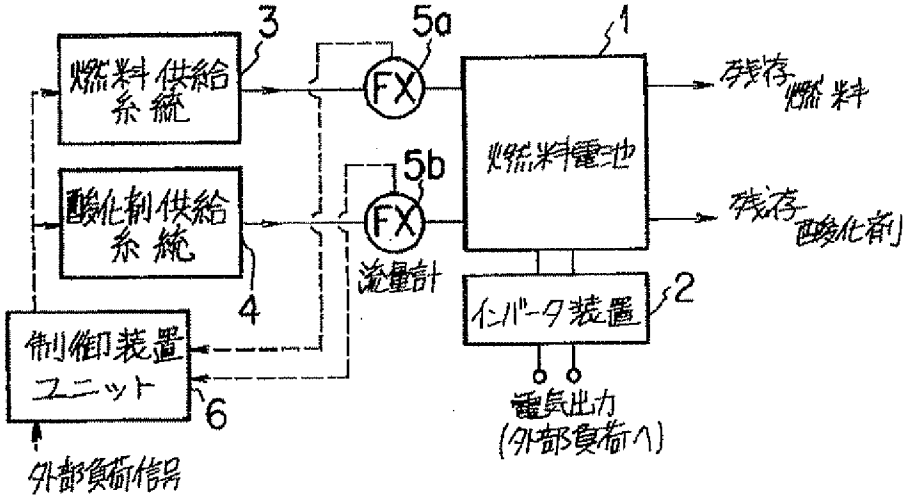
【符号の説明】

１１…燃料電池、１２…インバータ装置、１３…燃料供給系統、１４…酸化剤供給系統、１７ａ、１７ｂ…圧力コントロール弁、１８…制御装置ユニット。

【図１】



【図２】



【図3】